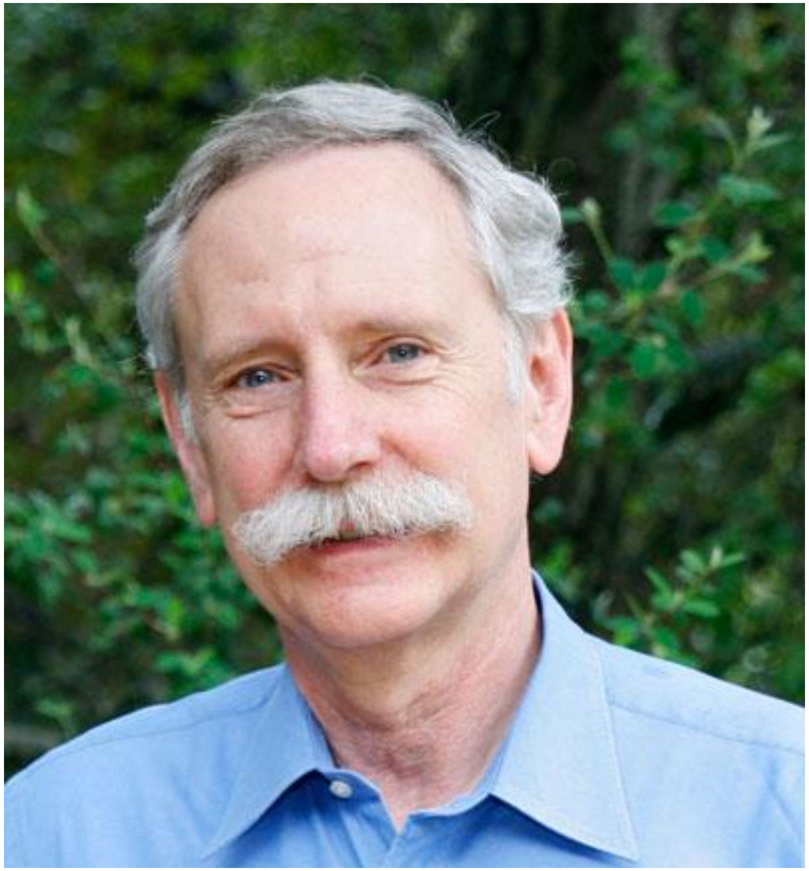
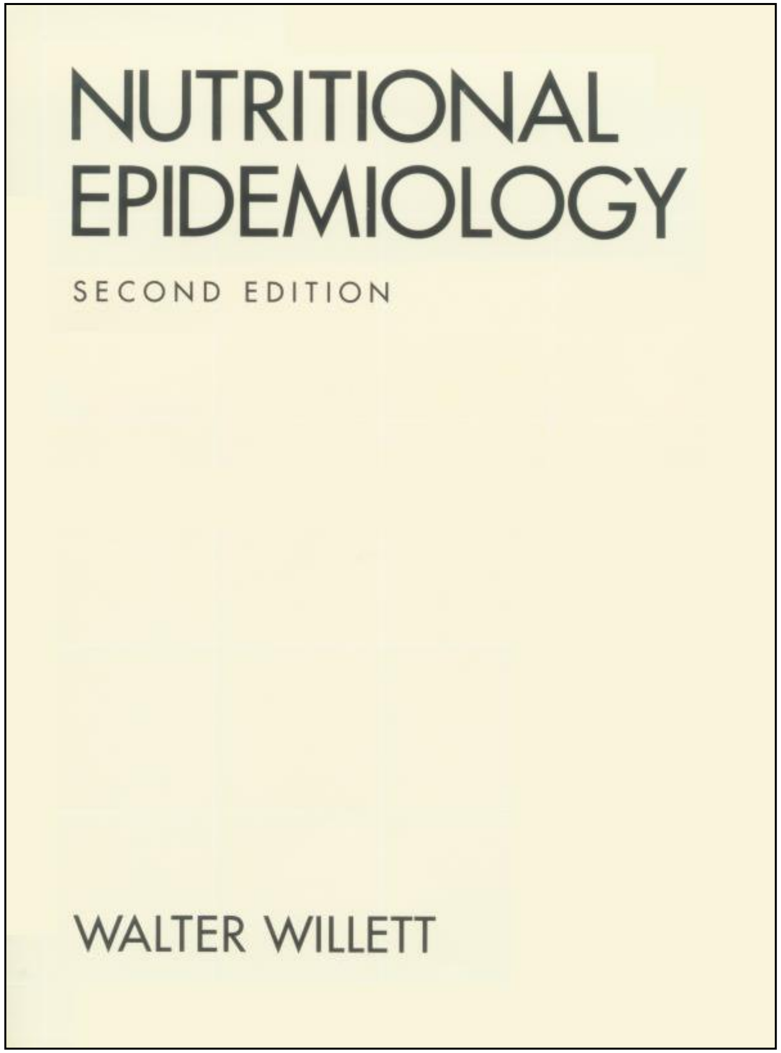
Nutritional Epidemiology



Walter Willett, MD, DrPH
Chair, Department of Nutrition
Harvard School of Public Health



NUTRITIONAL EPIDEMIOLOGY
SECOND EDITION

WALTER WILLETT

Is Zero Nutritional Value a Good Thing?

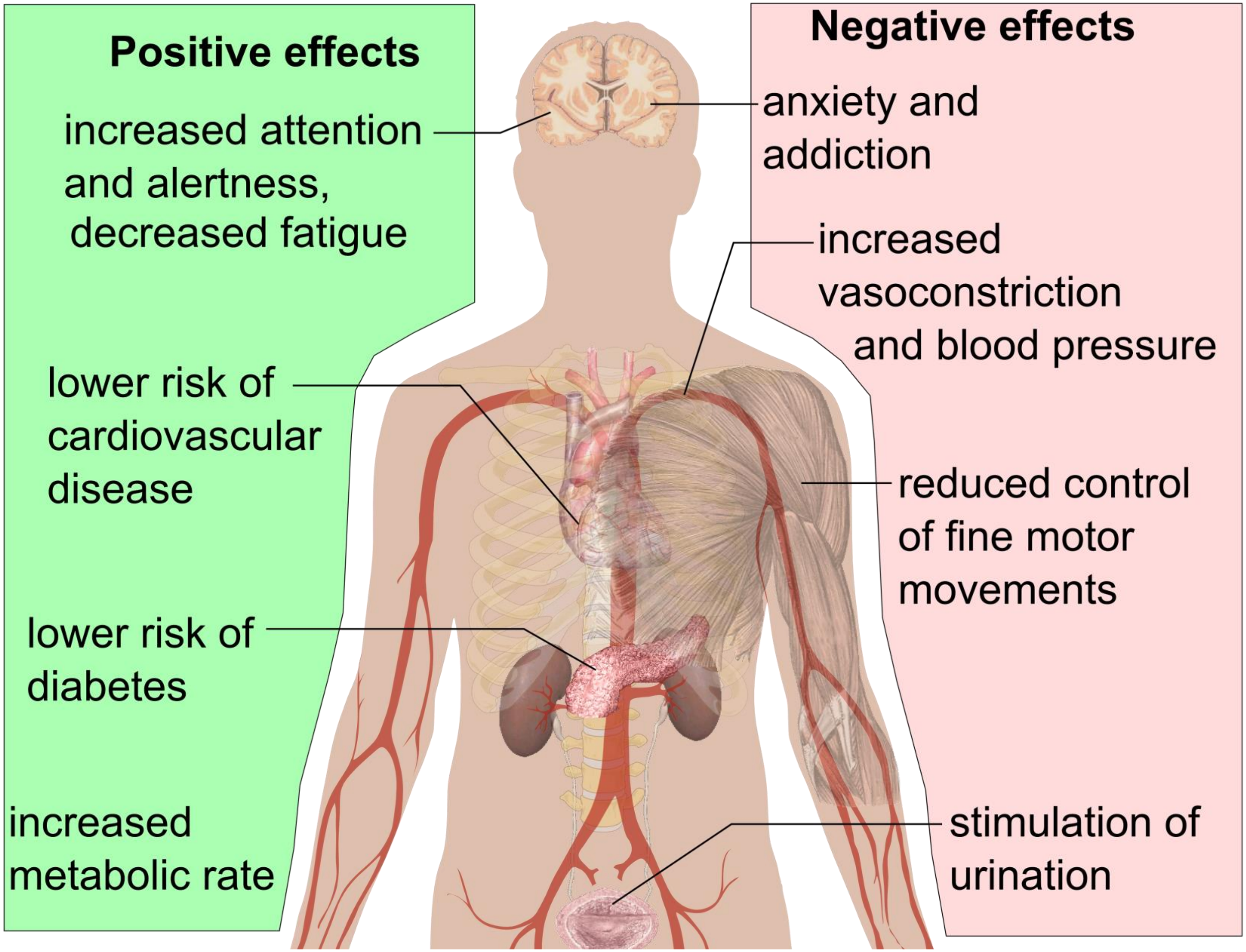
What to Drink?

- Juice
- Soda
- Coffee
- Tea
- Alcohol
- **Water?**

Coffee

- Previous negative studies confounded by cigarette smoking
- Caffeine may be problematic for some
- Benefits
    - Decreased chance of kidney stones
    - Decreased chance of gallstones
    - Decreased chance of Type II Diabetes
    - Decreased risk of Parkinson’s Disease
    - Fewer suicides

Health effects of caffeine



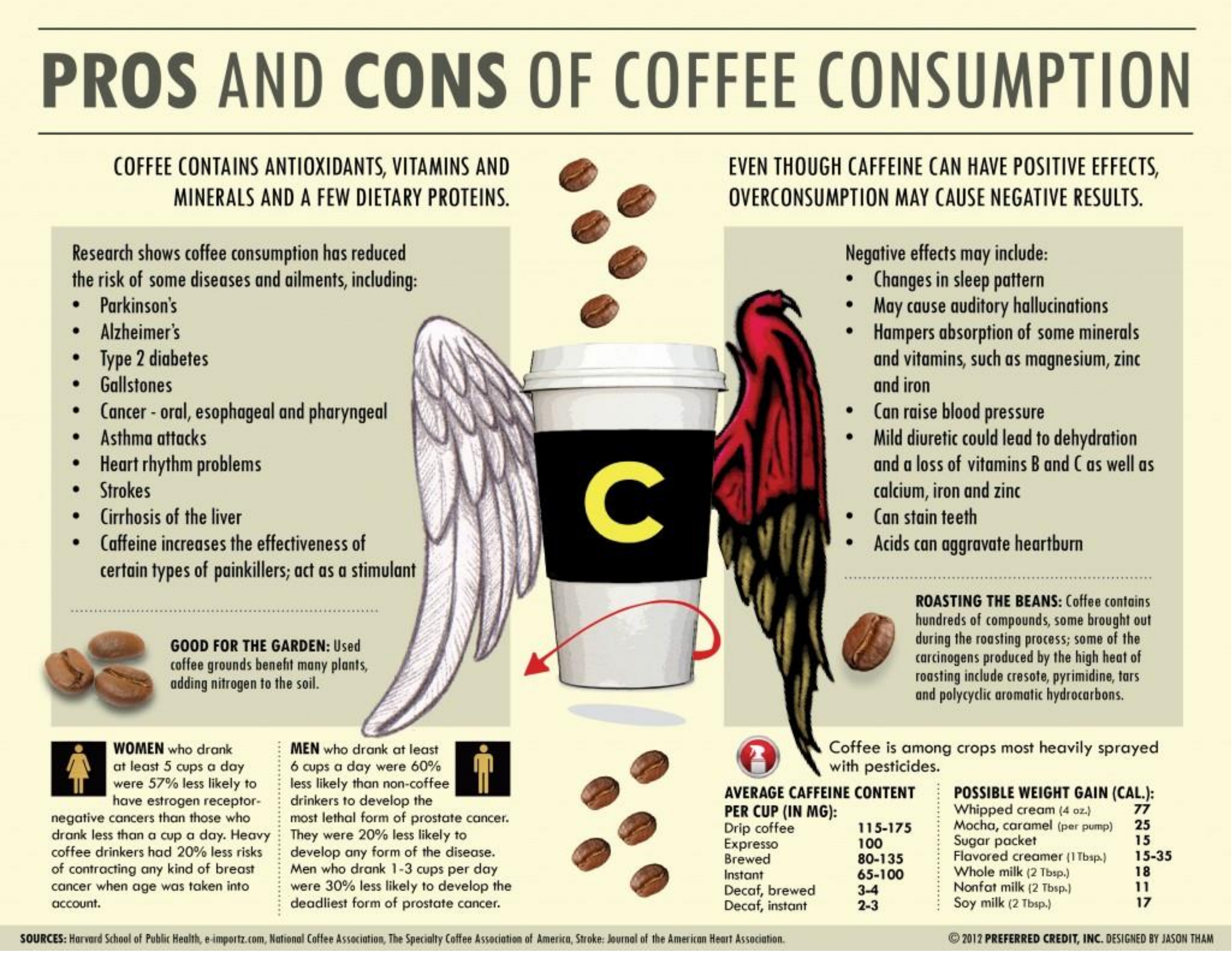
Positive effects

- increased attention and alertness, decreased fatigue
- lower risk of cardiovascular disease
- lower risk of diabetes
- increased metabolic rate

Negative effects

- anxiety and addiction
- increased vasoconstriction and blood pressure
- reduced control of fine motor movements
- stimulation of urination

https://upload.wikimedia.org/wikipedia/commons/1/11/Health_effects_of_caffeine.png



PROS AND CONS OF COFFEE CONSUMPTION

COFFEE CONTAINS ANTIOXIDANTS, VITAMINS AND MINERALS AND A FEW DIETARY PROTEINS.

Research shows coffee consumption has reduced the risk of some diseases and ailments, including:

- Parkinson's
- Alzheimer's
- Type 2 diabetes
- Gallstones
- Cancer - oral, esophageal and pharyngeal
- Asthma attacks
- Heart rhythm problems
- Strokes
- Cirrhosis of the liver
- Caffeine increases the effectiveness of certain types of painkillers; act as a stimulant

GOOD FOR THE GARDEN: Used coffee grounds benefit many plants, adding nitrogen to the soil.

WOMEN who drank at least 5 cups a day were 57% less likely to have estrogen receptor-negative cancers than those who drank less than a cup a day. Heavy coffee drinkers had 20% less risks of contracting any kind of breast cancer when age was taken into account.

MEN who drank at least 6 cups a day were 60% less likely than non-coffee drinkers to develop the most lethal form of prostate cancer. They were 20% less likely to develop any form of the disease. Men who drank 1-3 cups per day were 30% less likely to develop the deadliest form of prostate cancer.

EVEN THOUGH CAFFEINE CAN HAVE POSITIVE EFFECTS, OVERCONSUMPTION MAY CAUSE NEGATIVE RESULTS.

Negative effects may include:

- Changes in sleep pattern
- May cause auditory hallucinations
- Hampers absorption of some minerals and vitamins, such as magnesium, zinc and iron
- Can raise blood pressure
- Mild diuretic could lead to dehydration and a loss of vitamins B and C as well as calcium, iron and zinc
- Can stain teeth
- Acids can aggravate heartburn

ROASTING THE BEANS: Coffee contains hundreds of compounds, some brought out during the roasting process; some of the carcinogens produced by the high heat of roasting include cresote, pyrimidine, tars and polycyclic aromatic hydrocarbons.

Coffee is among crops most heavily sprayed with pesticides.

AVERAGE CAFFEINE CONTENT PER CUP (IN MG):	
Drip coffee	115-175
Expresso	100
Brewed	80-135
Instant	65-100
Decaf, brewed	3-4
Decaf, instant	2-3

POSSIBLE WEIGHT GAIN (CAL.):	
Whipped cream (4 oz.)	77
Mocha, caramel (per pump)	25
Sugar packet	15
Flavored creamer (1 Tbsp.)	15-35
Whole milk (2 Tbsp.)	18
Nonfat milk (2 Tbsp.)	11
Soy milk (2 Tbsp.)	17

SOURCES: Harvard School of Public Health, e-importz.com, National Coffee Association, The Specialty Coffee Association of America, Stroke: Journal of the American Heart Association.

© 2012 **PREFERRED CREDIT, INC.** DESIGNED BY JASON THAM

http://bestcoffeemakerlist.com/side-effects-of-drinking-too-much-coffee/

Tea

- Similar benefits to coffee (decreased kidney and gallstones)
- Additionally flavonoids may help with cholesterol and artery function – have also been linked to anti-cancer activity though evidence is mixed
- Can get flavonoids elsewhere – berries and other fruits and vegetables

Alcohol

- Risks (over-consumption)
  - Liver disease
  - Certain cancers
  - Hypertension
  - Strokes
  - Weakens heart and other muscles
- Benefits (in moderation)
  - Raises HDL
  - Reduces clot formation
  - May help with diabetes and gallstones

How much?

- Men: 1 – 2 drinks per day may be protective against heart attacks
- Women: 1 drink a day may be protective against heart disease
    - More than this may increase breast cancer risk (especially if folic acid intake is low)

Willett on Alcohol

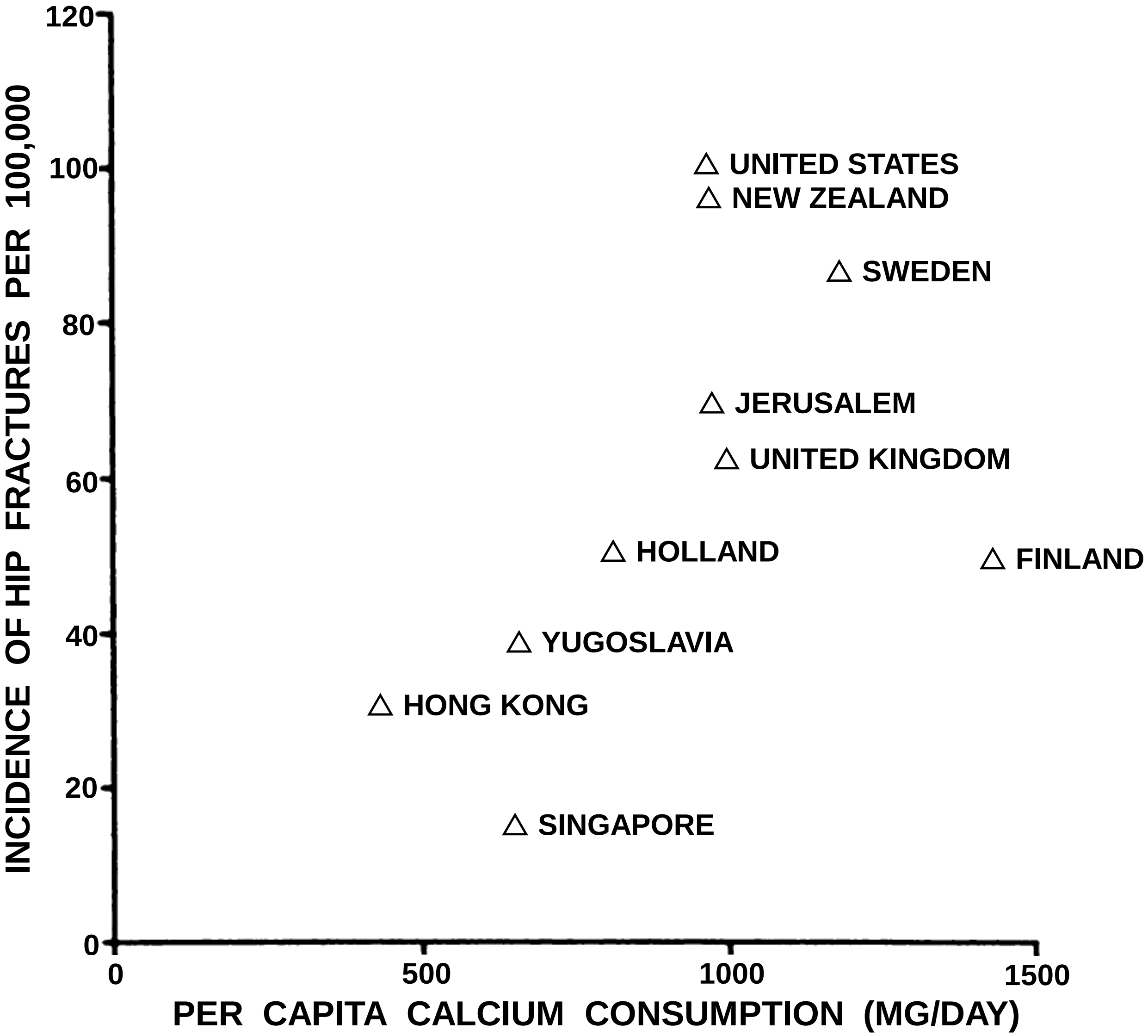
- Don’t start drinking because of alcohol benefits – can get same through exercise
- If you drink – be sure it’s in moderation
- Binge drinking isn’t helpful – it is harmful
- Men and women have different considerations with alcohol
- Low HDL that isn’t helped through exercise and diet may respond to moderate alcohol

Willett, Nutritional Epidemiology, p. 157

Calcium

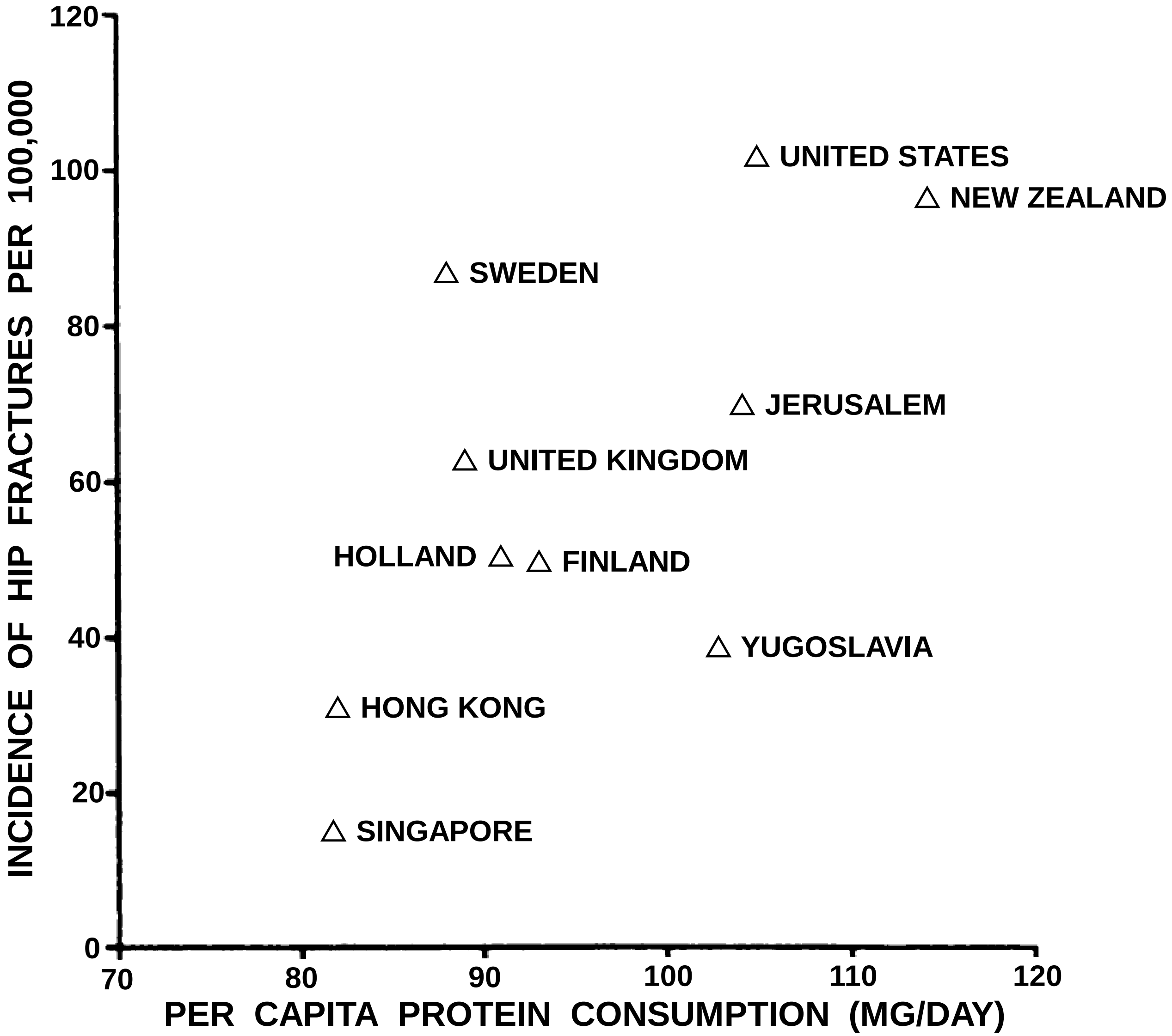
- The US is near the top in terms of Calcium consumption, yet still experiences problems with osteoporosis—why?
- No convincing evidence that increased milk consumption is protective
- Men: High Calcium intake is associated with prostate cancer
- Women: High Calcium intake is associated with ovarian cancer
- Nutritional package of milk is problematic

Calcium and Osteoporosis



http://www.ncbi.nlm.nih.gov/pubmed/3794834

Protein and Osteoporosis



http://www.ncbi.nlm.nih.gov/pubmed/3794834

Problems with Milk as Primary Calcium Source

- Lactose intolerance
- Saturated fat
- Extra calories
- Unneeded hormones
- Increased risk of prostate cancer?
- Increased risk of ovarian cancer?
- Full-fat dairy associated with breast cancer

Also, check the nutrient make-up of cow vs. human milk!

Willett, Nutritional Epidemiology, p. 165

Keys to Bone Health

- Exercise – weight-bearing, muscle strengthening
- Vitamin D – supplementation may be necessary
- Vitamin K – greens
- Other considerations: post-menopausal women and hormones, protein consumption

"It is abundantly clear that active, healthy people who get only low to moderate amounts of calcium have low fracture rates."

Willett, Nutritional Epidemiology, p. 173

Vitamins

- *"A carbon-containing compound essential in small quantities for normal functioning of the body."*
- Water soluble vitamins
  - Vitamin C and 8 B vitamins
- Fat soluble vitamins
  - A, D, E, K

Willett, Nutritional Epidemiology, p. 176

B Vitamins

- B1 = Thiamin
- B2 = Riboflavin
- B3 = Niacin
- B5 = Pantothenic Acid
- B6 = Pyridoxine
- B7 = Biotin
- B9 = Folic Acid
- B12 = Cobalamin

Antioxidants

- Important because they protect cells, tissues, proteins and DNA against free radicals
- Free radicals are products of metabolism that are hungry for electrons and will take them from whatever is available
- Free radicals are also present in the environment: food, air, water, tobacco smoke
- Key theory of aging is that it results from development of free radicals
- Antioxidants can lose an electron without becoming a damaging substance themselves

Free Radicals

- Believed to play a role in:
  - Cancer
  - Heart Disease
  - Arthritis
  - Cataract formation/macular degeneration
  - Memory Loss
  - Aging

Antioxidants

- Vitamins C, E, Beta-carotene, Carotenoids, Selenium, Manganese
- Others of interest = Glutathione, CoQ10, Lipoic Acid, Flavonoids, Phenols, Polyphenols, Phytoestrogens

Vitamin A

- Important for
  - Vision
  - Maintaining cells that line body
  - Production and activity of WBCs
  - Bone remodeling
  - Cell growth and differentiation
- Too much Vitamin A has a negative effect on bone (stimulates osteoclasts) and blocks Vitamin D (positive for bone and cancer)
- Keep intake of retinol below 2000 IU per day
- Look for supplement that gets Vitamin A from beta-carotene

Carotenoids

- Beta-carotene (orange), Lycopene (red), Lutein, Zeaxanthin, Alpha-carotene (there are hundreds of carotenoids)
- Carotenoids are generally converted to Vitamin A and/or act as antioxidants
- Thought to be helpful in preventing heart disease, cancer, memory loss, aging, cataracts and macular degeneration
- Fruit and vegetable consumption is important for these nutrients

Vitamin C

- An antioxidant that helps make collagen and hormones.
- Food sources = citrus, berries, green and red peppers, tomatoes, broccoli, spinach
- Willett recommends 200 – 300 mg/day; current RDI is 75 mg for women, 90 mg for men (add 35 mg if smoker)

Vitamin E

- Mixed results in trials for effect on heart disease
- Thought to prevent cancer but mixed research results as well
- RDI = 15 mg per day (= 22 IU natural)
- Willett encourages 400 IU per day
- If on blood thinners need to be careful with this vitamin

Vitamin E

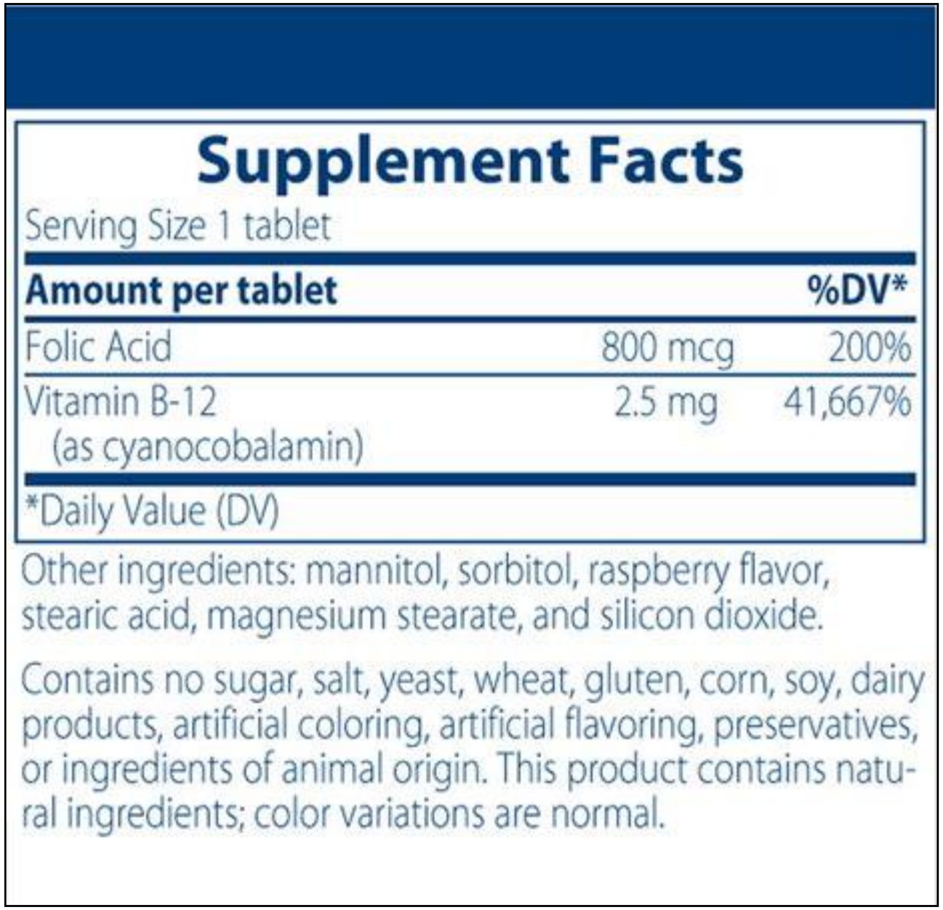
"The failure of the medical establishment during the last forty years to recognize the value of Vitamin E in controlling heart disease is responsible for a tremendous amount of unnecessary suffering and for many early deaths. The interesting story of the efforts to suppress the Shute discoveries about Vitamin E illustrates the shocking bias of organized medicine against nutritional measures for achieving improved health.“

~ Linus Pauling ~

http://www.doctoryourself.com/estory.htm

B6, B12, Folic Acid

- Seem to reduce **homocysteine levels** which has an impact on atherosclerosis (heart attack and stroke)
- B6 also believed to help with PMS
- B12 special concern for vegans and older people who lose ability to absorb it from food
- **Folate** involved in embryonic development of spinal cord. Builds DNA. Adequate levels may prevent cancer.
- B6 1.3 – 1.7 mg/day
- B12 2.4 mcg/day
- Folic Acid 400 mcg/day



Supplement Facts

Serving Size 1 tablet

Amount per tablet		%DV*
Folic Acid	800 mcg	200%
Vitamin B-12 (as cyanocobalamin)	2.5 mg	41,667%

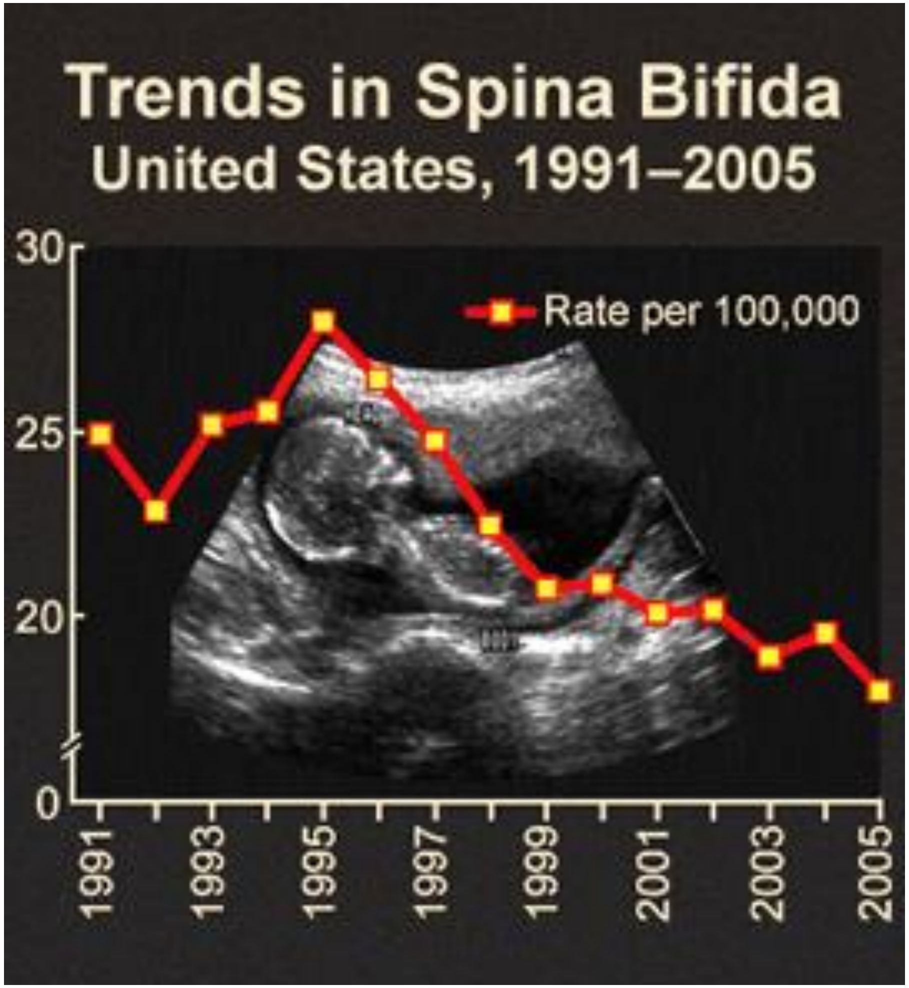
*Daily Value (DV)

Other ingredients: mannitol, sorbitol, raspberry flavor, stearic acid, magnesium stearate, and silicon dioxide.

Contains no sugar, salt, yeast, wheat, gluten, corn, soy, dairy products, artificial coloring, artificial flavoring, preservatives, or ingredients of animal origin. This product contains natural ingredients; color variations are normal.

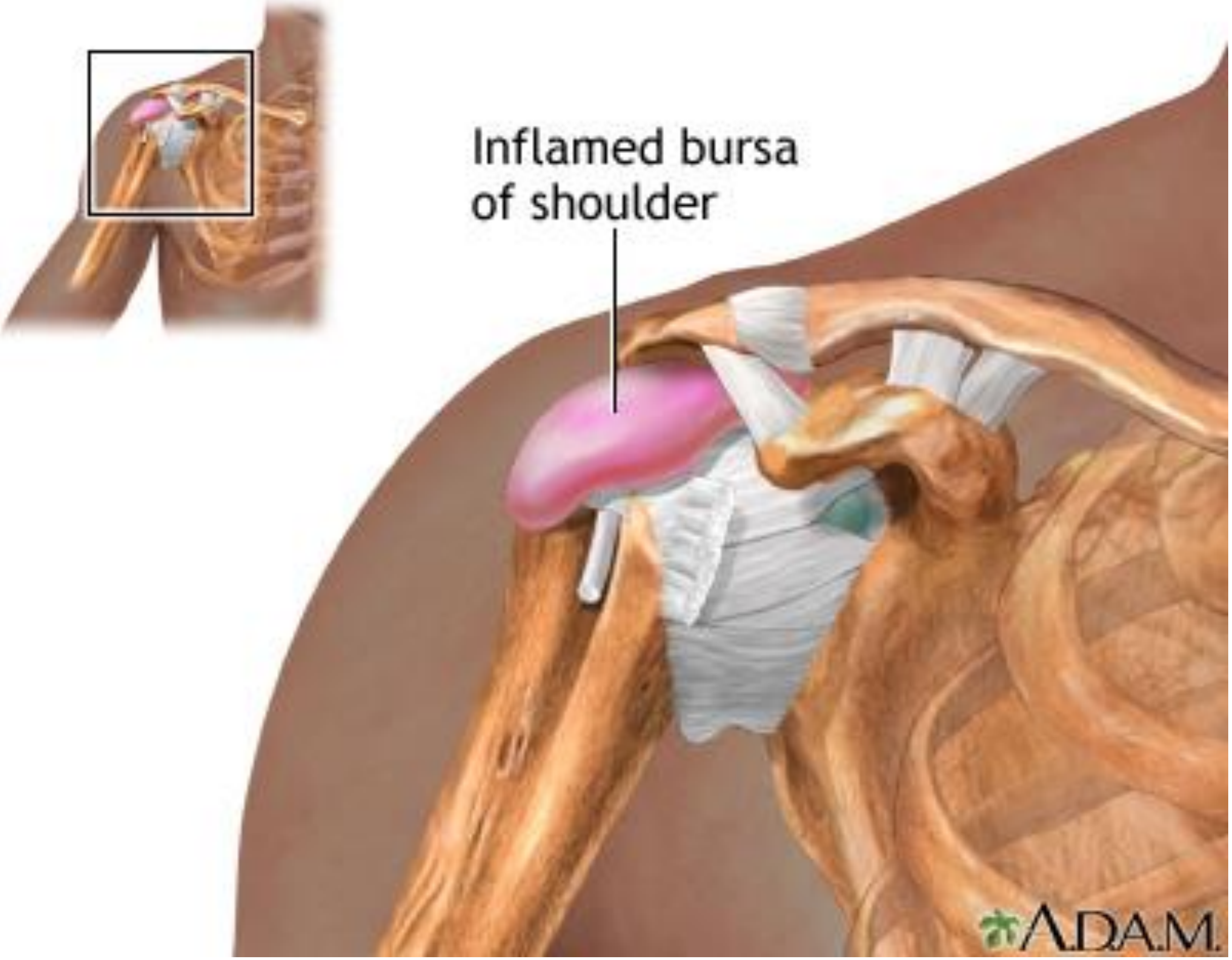
https://www.emersonecologics.com/Products/EmersonMain/PID-HIB12.aspx

Folic Acid Fortification Began in 1996



http://www.cdc.gov/features/dsSpinaBifida/

Vitamin B_{12} for Bursitis



http://wrightnewsletter.com/2008/07/09/banish-bursitis-once-and-for-all/

Vitamin D

- Hormone made by skin reacting with sunlight
- Few foods contain Vitamin D – some types of fish (specifically their livers)
- Important in bone formation, muscle cells, may inhibit cancer cells, heart disease, MS
- RDI = 200 IU
- Willett recommends 800 – 1,000 IU *
- "Pediatricians double Vitamin D requirement"

  http://abcnews.go.com/Health/story?id=6006566

* *This is now considered accepted science on D*

Vitamins Summarized

- Willett recommends a daily multivitamin for insurance
  - Not to replace healthy eating
- Tips for choosing multivitamin
  - Vitamin A from beta carotene vs. retinol
  - 400 IU of Vitamin E – may need an additional supplement to get this
  - Vitamin D at 800 – 1,000 IU may require additional supplement, too
  - Women may need additional calcium and iron

Willett Summarized

- Foundation is to maintain a healthy, stable weight
- If overweight attempt to lose, if at ideal weight maintain
- Replace saturated fats and trans fats with unsaturated fats
- Replace refined grains with whole grains
- Choose healthier proteins – nuts and beans, leaner meats
- Lots of vegetables and fruits
- Moderate alcohol
- Multivitamin

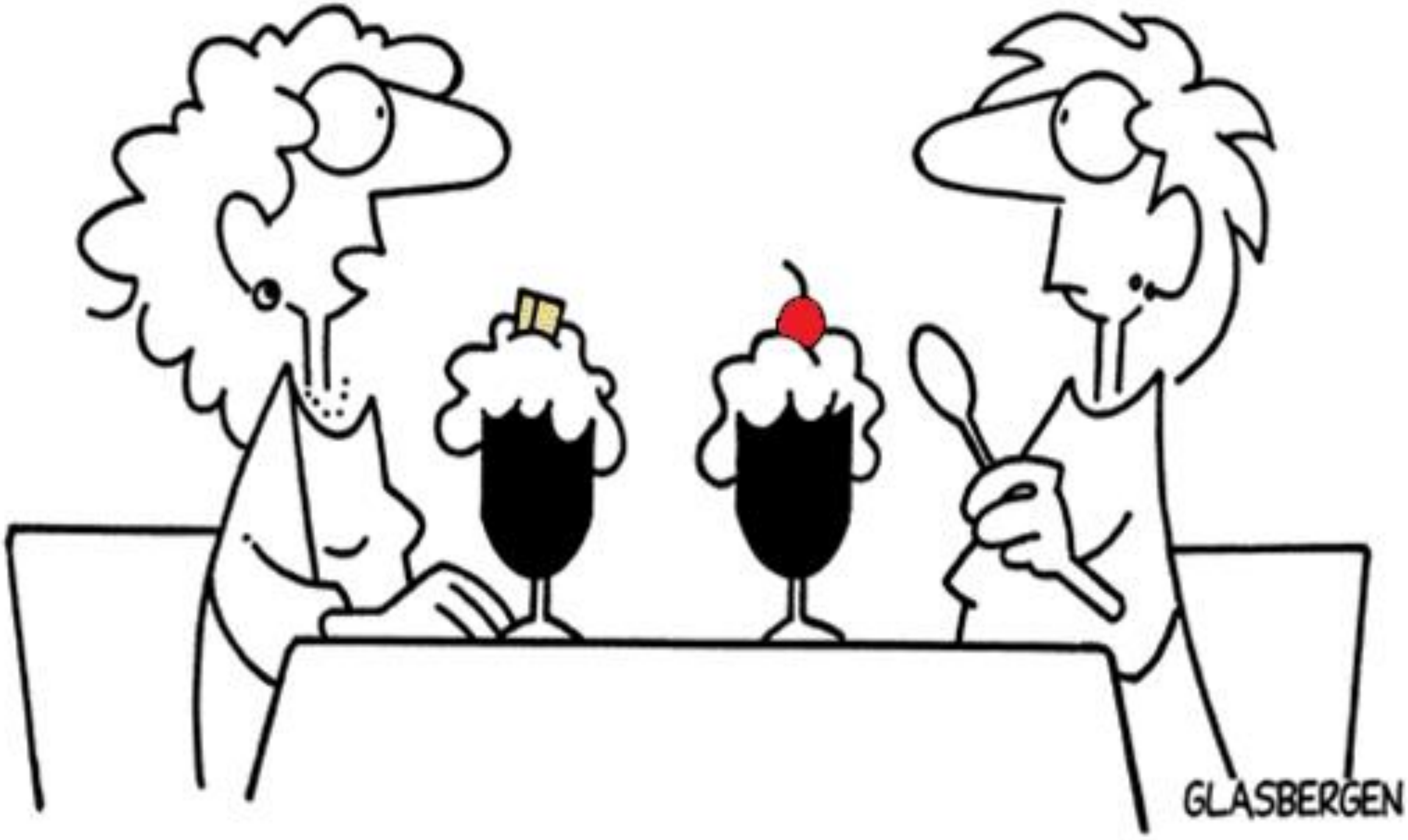
Basic Principles of Good Diets

"The basic principles of good diets are so simple that I can summarize them in just ten words: eat less, move more, eat lots of fruits and vegetables.

For additional clarification, a five-word modifier helps: go easy on junk foods."

Marion Nestle *What to Eat*

http://www.amazon.com/What-Eat-Marion-Nestle/dp/0865477388/



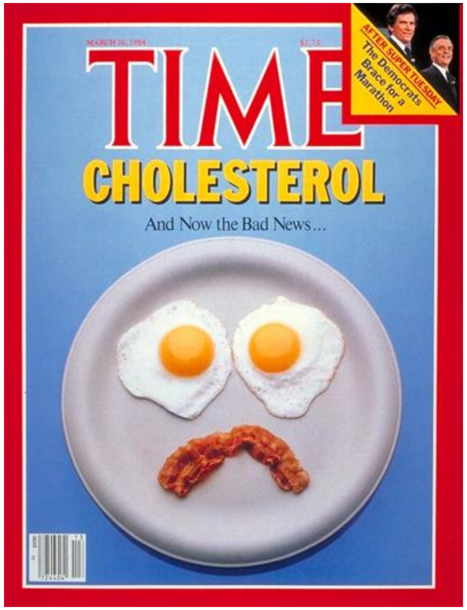
“If you put a crouton on your sundae instead of a cherry, it counts as a salad.”

General Principles of Dietary Counseling

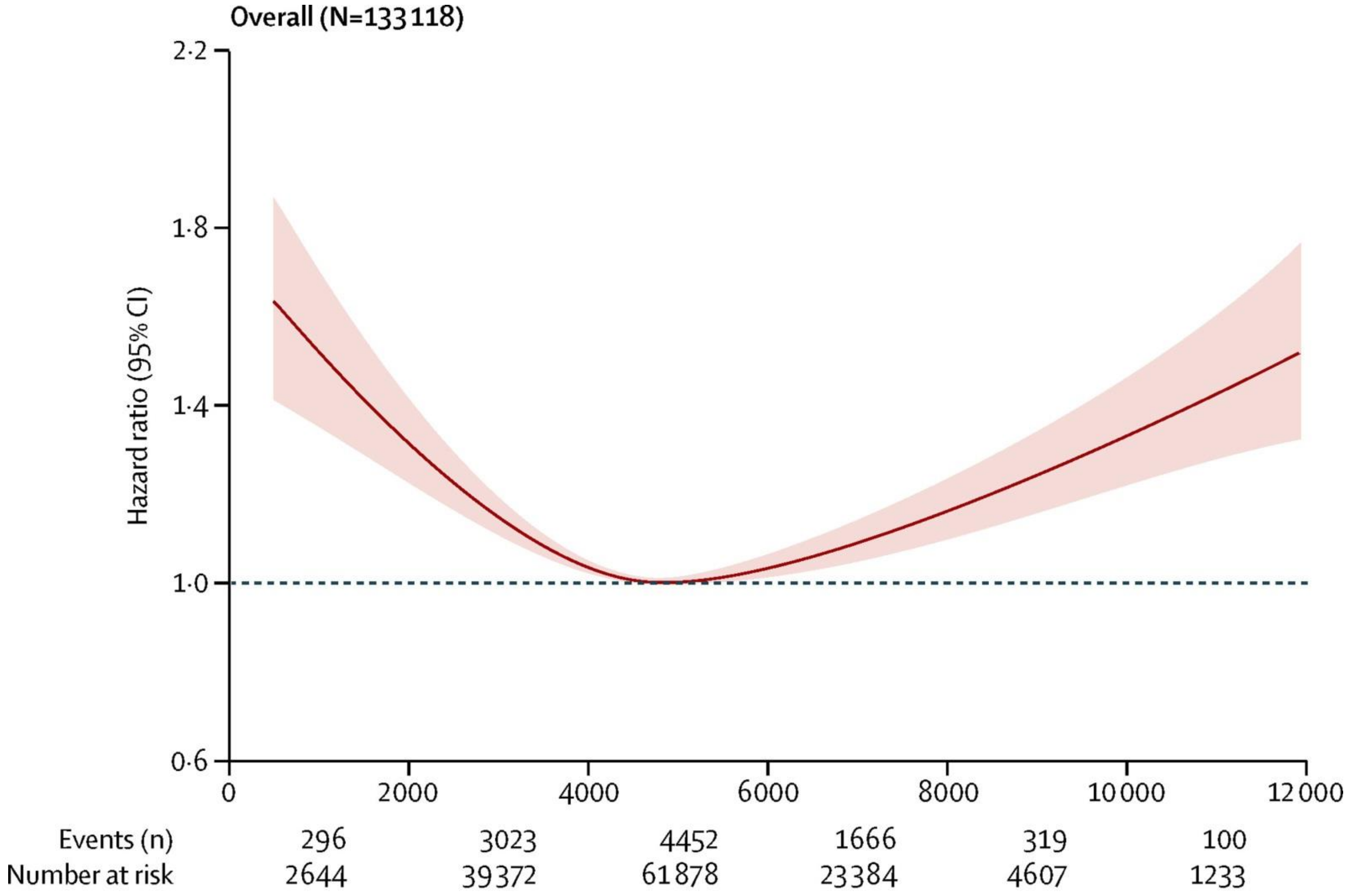
- Goals
  - Achieve/maintain normal weight
  - Achieve/maintain healthy blood pressure
  - Achieve/maintain healthy serum cholesterol (screen men at age 35, women at age 45)
- Quick dietary screen
  - Variety
  - Balance
  - Proportion of high fat/high calorie foods

Quantitative Dietary Goals

- Balance of energy in and out
- < 30% fat
- < 10% saturated fat
- < 300 mg/day of cholesterol
- No more than 3.3 g Na/day
- 30 g fiber/day



Optimum Sodium Intake?



http://www.sciencedirect.com.ezproxy.parker.edu/science/article/pii/S0140673616304676
http://www.dailymail.co.uk/health/article-3601799/Eating-LITTLE-salt-INCREASE-risk-heart-attack-stroke-claims-controversial-new-research.html

Take Note

- Factors that affect food intake
  - Resources – financial
  - Housing – and cooking facilities
  - Employment
  - Family, culture, social factors
  - Transportation – public/private
  - Geographical factors – shopping?
  - Likes/dislikes

Special Populations

- Children and adolescents
- Pregnancy/lactation
  - Emphasize fruit and vegetable consumption
  - Folic acid needed 7 weeks prior to Pregnancy
  - Discourage smoking, alcohol
  - Iron during 2 & 3 trimester (?)
  - Encourage breastfeeding
- Vegetarians/vegans
- Elderly – change in functional status and decrease in taste
- Athletes?

Dietary Strategies to Prevent Heart Disease

- Emphasize non-hydrogenated and unsaturated fats – eliminate saturated fats
- Consume Omega-3 fats
- Consume generous amounts of vegetables, fruits, nuts and whole grains
- Eat cold water fish
- Limit red meat to 12 oz. per week

Overnutrition

- Results from
  - Decreased need for physical labor
  - Production of food in excess of need
  - Consumption of animal products rather than plant products
  - Increase in sedentary activities
  - Promotion of processed food over whole food via advertising

Metabolic Pathways to Obesity

- *High-calorie Overweight:* began overeating as an adult
- *Familial Overweight:* eating patterns in family lead to overeating in childhood
- *Dieting Induced Low Calorie Overweight:* repeated diets have reduced Resting Metabolic Rate (RMR), so even normal or low calorie intake results in stable weight or even some gain
- *Genetic Predisposition Low Calorie Overweight:* lowered RMR results from genetic propensity/disease

How to Achieve Normal Weight?

- High calorie overweight – must take in fewer calories or burn them off through exercise
- Familial overweight – equal importance to calorie reduction and exercise
- Dieting-induced and genetic predisposition low calorie overweight – EXERCISE is first step and eating change comes later

Calorie Requirements

- To calculate the daily caloric requirement needed to maintain present weight
  - Sedentary: 30 kcal for every 2.2 pounds
  - Moderately active: 35 kcal for every 2.2 pounds
  - Extremely active: 40 kcal for every 2.2 pounds
- To lose weight, can simply reduce intake by 500 calories a day
  - Women: never drop below 1,200 cal/day
  - Men: never drop below 1,500 cal/day

Yo-Yo Dieting

- Starvation Response – In response to sudden calorie decrease, the resting metabolic rate (RMR) will decrease within 24 – 36 hours; a second drop in calories can further decrease the RMR
- RMR can be raised through exercise (aerobic + strength training to increase muscle mass)

Societal Norms and Weight

- Weight loss goals are often set based upon societal demands (*unrealistic* target weights)
- Focus on healthy habits for the long term (exercise, eating choices, self-esteem)
- Weight management vs. diet

Malnutrition

- Type A – calorie and/or micronutrient malnutrition associated with the developing world
- Type B – multiple micronutrient depletion usually existing with **calorific balance or excess**

Two Major Deficiencies

- *Marasmus* – wasting syndrome, deficiency in all nutrients
- *Kwashiorkor* – protein malnutrition, generally occurs following weaning to protein deficient food source
- Synergism between malnutrition and infection

These are National Board Questions

The “Good” Fats

- Omega-3s – essential fats that can’t be made by the body
  - Used for cell membranes, hormones, inflammation
  - Demonstrated to be useful in preventing heart disease, stroke and some autoimmune disorders

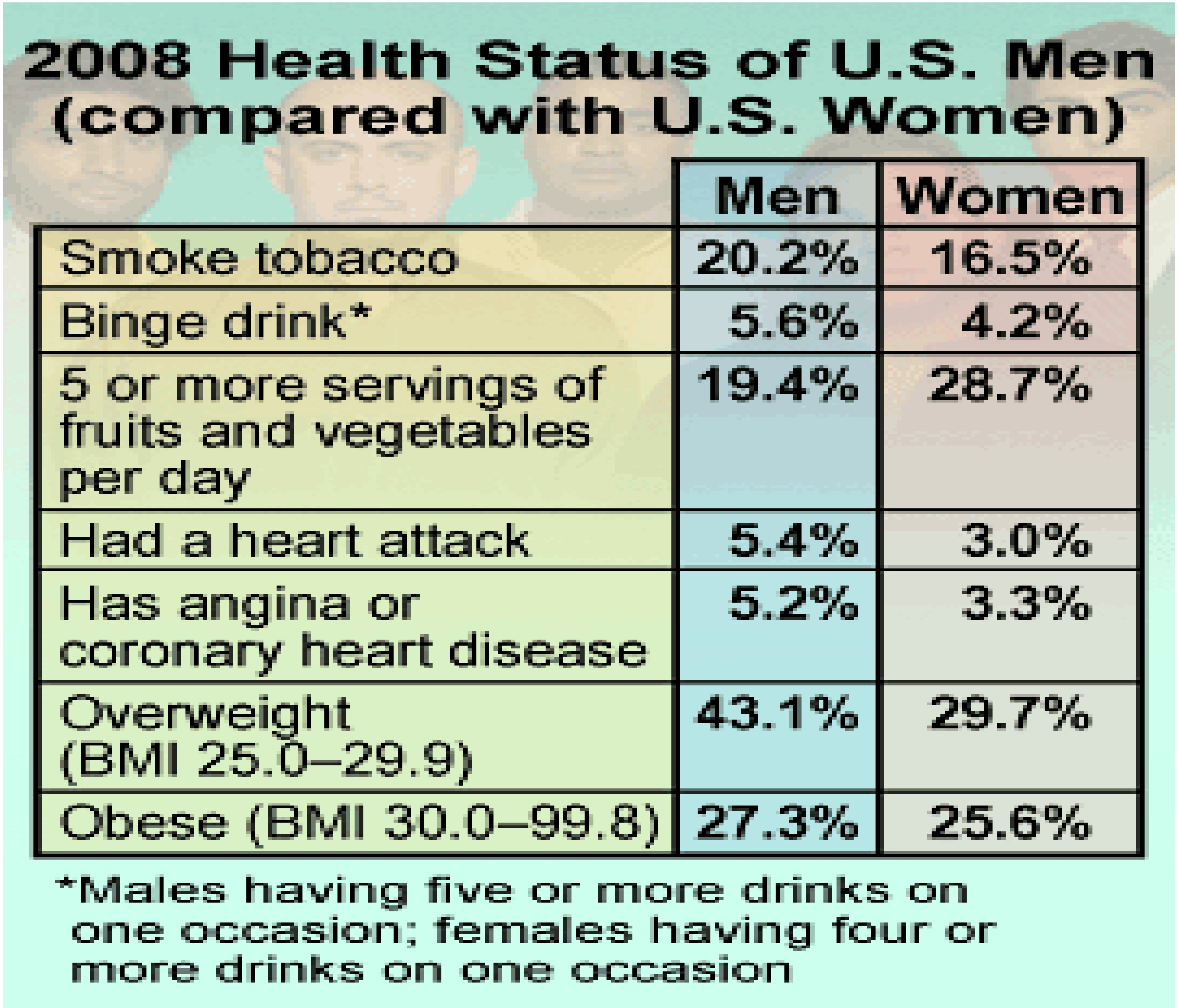
- Sources – fish, walnuts, flax oil/seeds

Standard American Diet (SAD)

- In the US, carbohydrates make up half of the total calories, coming from:
  - Bread
  - Soft drinks
  - Cakes, cookies, doughnuts
  - Sugar, syrup, jam
  - White potatoes
  - Cereal
  - Milk

A sugar by any other name will taste as sweet…

- Sucrose, fructose, glucose, dextrose, fruit juice concentrates, honey, molasses, HFCS, lactose, maltose, maple syrup, mannitol
- US average daily sugar intake = 31 tsp.



2008 Health Status of U.S. Men (compared with U.S. Women)

	Men	Women
Smoke tobacco	20.2%	16.5%
Binge drink*	5.6%	4.2%
5 or more servings of fruits and vegetables per day	19.4%	28.7%
Had a heart attack	5.4%	3.0%
Has angina or coronary heart disease	5.2%	3.3%
Overweight (BMI 25.0–29.9)	43.1%	29.7%
Obese (BMI 30.0–99.8)	27.3%	25.6%

*Males having five or more drinks on one occasion; females having four or more drinks on one occasion

Behavioral Risk Factor Surveillance System data

Protein

- Need about 7 grams for each 20 pounds body weight

> *"Indeed, unless your diet is unusually restrictive, you will get enough protein as long as you get enough calories."*
>
> Marion Nestle

Protein Package

- Red meats
    - Hard on environment
    - Full of saturated fat
    - Ethical concerns?
- Replacement foods – soy
    - Health claims questionable
    - Estrogenic effects may be dangerous for women who already have breast cancer

Protein and Weight Loss

- Excess protein slows the emptying of the stomach so you feel full longer which can help in weight loss, but…
- Evens out blood sugar so that there isn’t a crash that encourages grabbing sweet snack

- Calcium loss with high protein diets?

Benefits of Whole Grains

- Better blood sugar control
- Decreased heart disease
- Better colon function
- May be important in cancer prevention (mouth, stomach, colon, gallbladder and ovarian)
- Benefits result from high fiber in whole grains as well as antioxidants, phytoestrogens, and minerals – in other words a combination of factors present in the WHOLE food

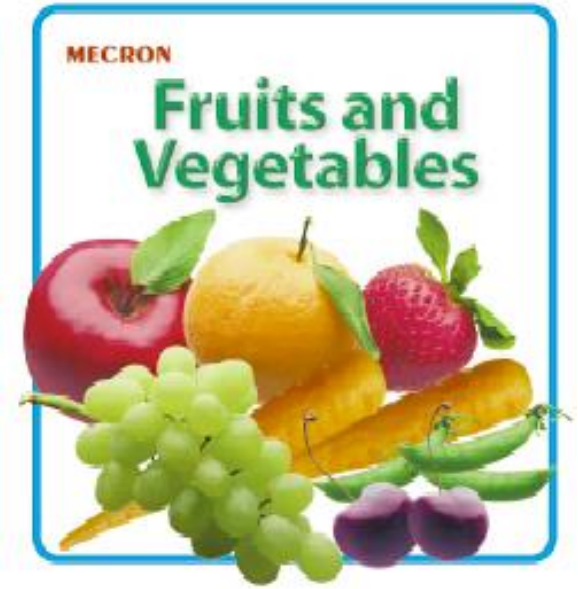
Benefits of Whole Grains

- Studies on consumption of whole grains show a significant reduction in risk of early mortality from ALL CAUSES

http://www.fruitsandveggiesmorematters.org/

Benefits of Fruits/Vegetables

- Decrease chances of heart attack/stroke
- Less constipation/diverticulitis
- Protect from cataracts and macular degeneration
- Delay/prevent memory loss, Alzheimer's?
- Feel full with fewer calories (weight control)
- Variety

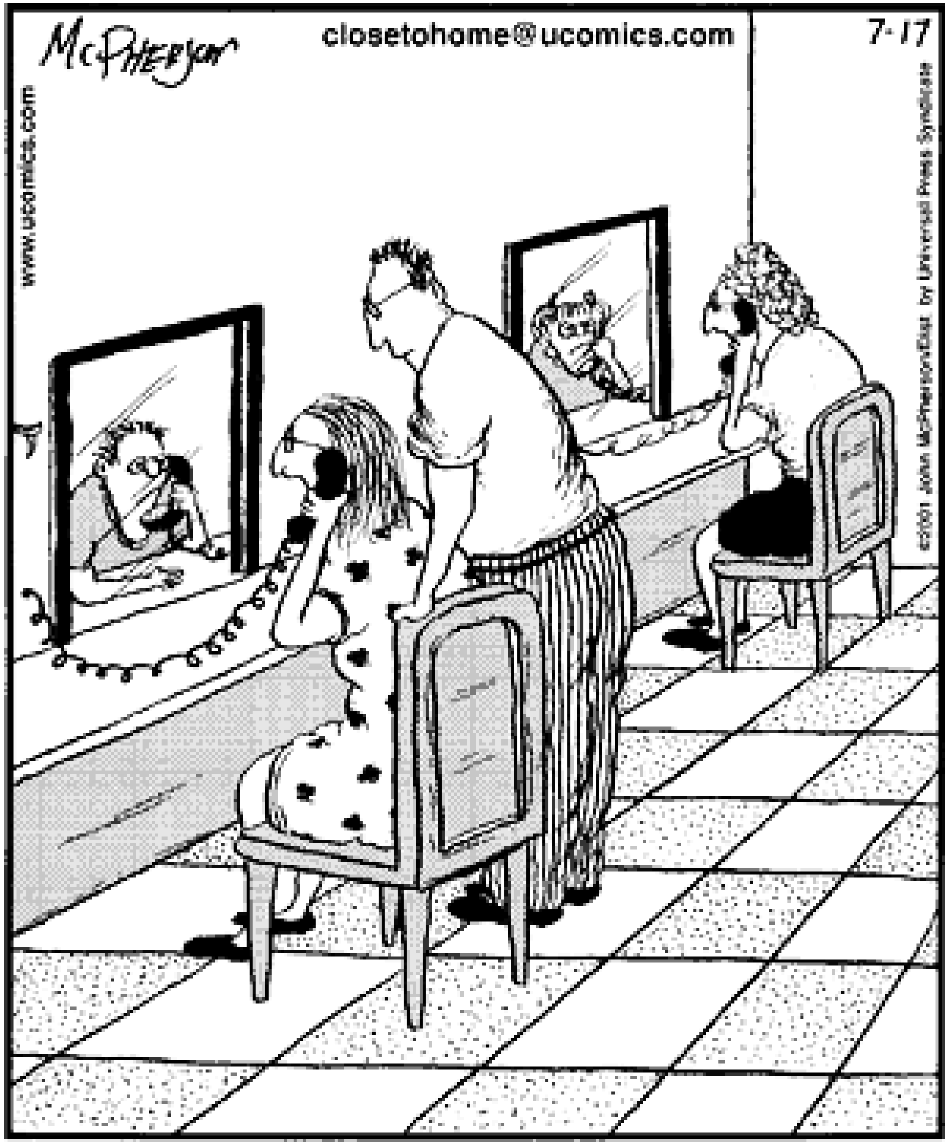


Willett, Nutritional Epidemiology, p. 132

Tips for Consuming

- Don’t count white potatoes
- Eat as a family and make healthy choices
- Five servings as minimum
- Consume a serving each day from each of the following
  - Dark green, leafy vegetables
  - Yellow/orange fruits and vegetables
  - Red fruits and vegetables
  - Legumes (beans) and peas
  - Citrus fruits

Willett, Nutritional Epidemiology, p. 145



“Kevin, we’ve been telling you for years, ‘Eat your vegetables or the Vegetable Police will get you!’ You thought it was just a big joke, ha, ha, ha.”

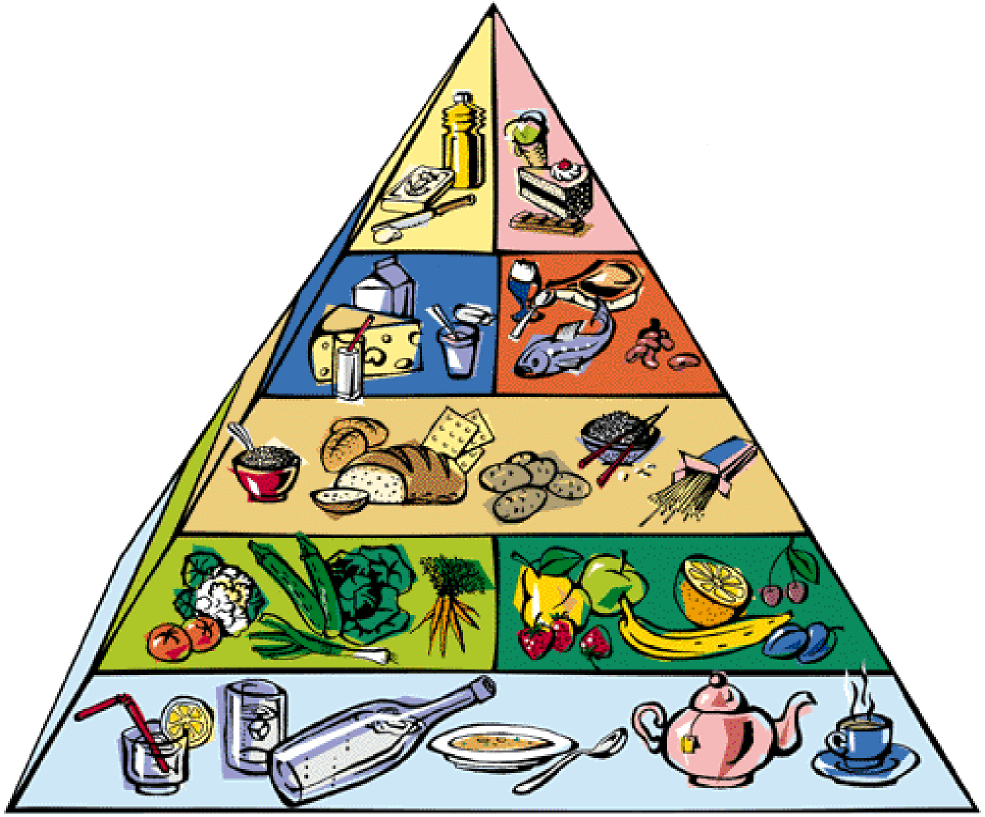
Optimal Diets for Prevention of Coronary Heart Disease

- Substantial evidence indicates that diets using nonhydrogenated unsaturated fats as the predominant form of dietary fat, whole grains as the main form of carbohydrates, an abundance of fruits and vegetables, and adequate omega-3 fatty acids can offer significant protection against CHD.
- Such diets, together with regular physical activity, avoidance of smoking, and maintenance of a healthy body weight, may prevent the majority of cardiovascular disease in Western populations.

JAMA. 2002 Nov 27;288(20):2569-78. http://www.ncbi.nlm.nih.gov/pubmed/12444864

Hu & Willett, 2002

- Avoid trans-fats
- Consume fish
- Adequate fruits and vegetables
- Whole grains
- Supplement omega-3s if necessary



JAMA. 2002 Nov 27;288(20):2569-78. http://www.ncbi.nlm.nih.gov/pubmed/12444864

Fish and Risk of Stroke in Men

- 12 year study of health professionals with a cohort of 43,671 men
- Risk of stroke was significantly lower among those who ate fish 1 to 3 times per month
- A higher frequency of fish intake was not associated with further risk reduction
  - Once a month was sufficient to achieve the protective effect in this study

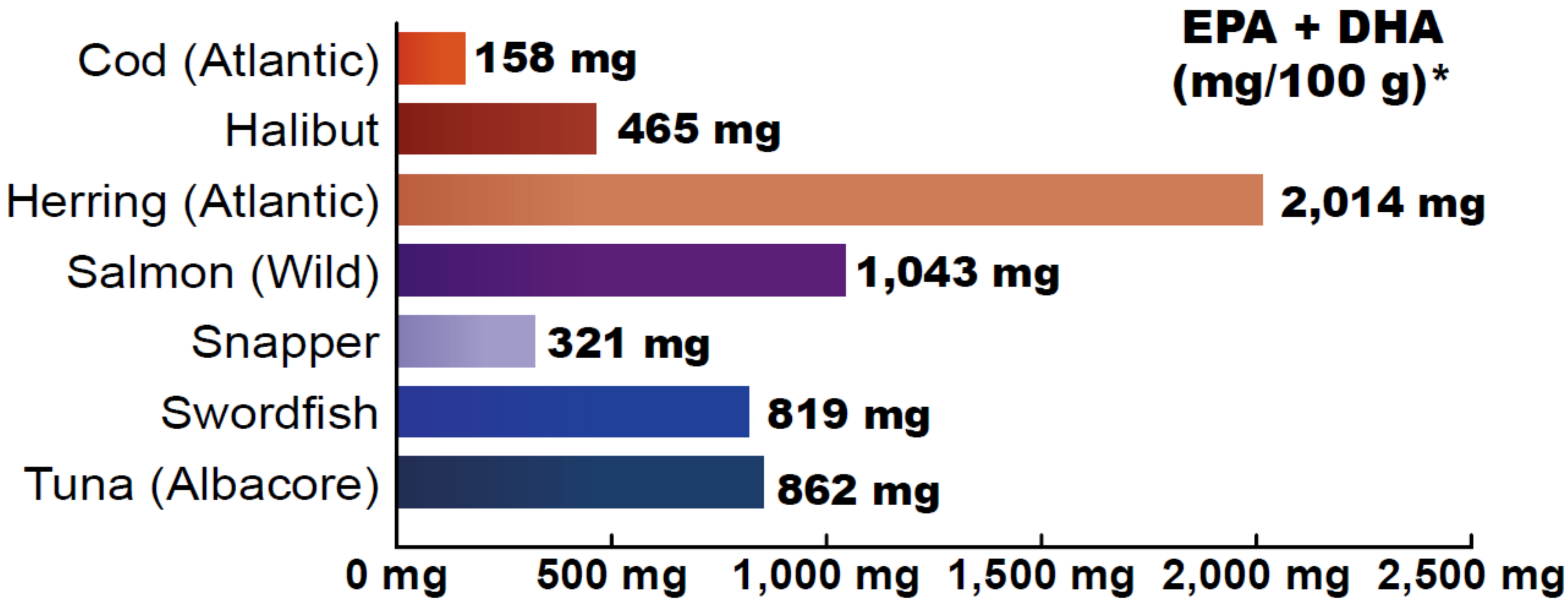
JAMA. 2002 Dec 25;288(24):3130-6. http://www.ncbi.nlm.nih.gov/pubmed/12495393

NIH Recommendations on Fish

“The NIH recommends a 3 oz. serving of deep-water ocean fish per month to reduce the risk of stroke in men.”

December 26, 2002

Fish Sources of Fatty Acids



*Data based on 3.5 oz portions.

In the general population, 250 mg/d of EPA and DHA is a reasonable target intake to reduce CHD mortality. This corresponds to one 6-oz serving/wk of wild salmon or similar oily fish.

Fish intake, contaminants, and human health: evaluating the risks and the benefits.
JAMA 10-18-06 http://www.ncbi.nlm.nih.gov/pubmed/17047219

The Escalating Pandemics of Obesity and Sedentary Lifestyle

- This epidemic demands that *all health care providers counsel* their patients on the need for continued dietary restraint (for lack of a better term) and exercise

- The DC is in a position to serve in some capacity, as a ***"health coach"*** if he or she chooses to do so

Arch Intern Med. 2004 Feb 9;164(3):249-58. http://www.ncbi.nlm.nih.gov/pubmed/14769621

Protective Effect of Fruits and Vegetables on Development of Stroke in Men

- Based upon the Framingham Study which began in 1948
- Age-adjusted risk of stroke in men decreased as servings of fruits and vegetables increased

JAMA. 1995 Apr 12;273(14):1113-7. http://www.ncbi.nlm.nih.gov/pubmed/7707599

Diet Summary

- All Patients need advice on diet
- Recommending 5-9 servings of fruits and vegetables to your patients and dispensing the "Get 5" brochure can be a start
- Serve as a resource person on diet and consider becoming a health coach for patients, networking with other providers, including dietitians when needed, to assist your patients in staying healthy and well

5 A Day
Eat a Variety of Colorful Fruits and Vegetables Every Day

When it comes to diet, maybe this sums it up?

"A good guideline is that if you enjoy doing something, stop doing it."